MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**STRAIN POLE FOUNDATION 6 BOLT, IN ROCK**

SIG:JYP 1 of 5 APPR:RWS:EMS:07-16-21

**a. Description.** This work consists of furnishing and installing a strain pole drilled shaft foundation and anchor bolts at locations where bedrock is encountered during excavation and is classified as such by the Engineer. Perform all work in accordance with the standard specifications, subsections 105.10, 718.03, 820.03.C, and 908.14.C of the Standard Specifications for Construction, and as specified herein.

**b. Drilled Shaft Submittals.** The following submittals are required to obtain approval from the Engineer prior to commencement of the work:

1. Qualifications of Contractor. The Contractor performing the work described in the contract must have installed drilled shafts with diameters and lengths into rock similar to those shown on the plans within the past 3 years. The Contractor’s supervisor must have at least 3 years of acceptable experience installing similar types of drilled shafts. Demonstrate to the Engineer that the Contractor’s supervisor and drillers performing the work have completed at least 3 projects of similar scope, drilled shaft diameters and lengths, and subsurface conditions to this project.

2. Submit a Drilled Shaft Installation Plan per subsection 718.03.A of the Standard Specifications for Construction.

3. Review and comment on soil boring logs per subsection 718.03 of the Standard Specifications for Construction.

**c. Materials.**

1. Concrete. Furnish concrete meeting the requirements of subsection 718.02 of the Standard Specifications for Construction.

2. Casings. Furnish casings meeting the requirements of subsection 718.02 of the Standard Specifications for Construction.

3. Slurry. Furnish slurry meeting the requirements of subsection 718.03.E of the Standard Specifications for Construction.

4. Anchor Bolts. Furnish anchor bolts for strain poles meeting the requirements of subsection 908.14 of the Standard Specifications for Construction

5. Conduit. Furnish conduit material meeting the requirements of section 818 of the Standard Specifications for Construction.

**d. Construction.** Ensure all work is in accordance with sections 718, 818, 819, and 820, and subsection 810.03 of the Standard Specifications for Construction, the applicable signal construction details, and this special provision.

1. Drilled Shaft Construction Methods.

A. Dry Construction Method. Must meet the requirements of subsection 718.03.B.1 of the Standard Specifications for Construction.

B. Wet Construction Method. Must meet the requirements of subsection 718.03.B.2 of the Standard Specifications for Construction.

C. Temporary Casing Construction Method. Must meet the requirements of subsections 718.03.B.3 or 718.03.B.4 of the Standard Specifications for Construction.

D. Construction Method Log. Must meet the requirements of subsection 718.03.B.5 of the Standard Specifications for Construction.

2. Casings. Must meet the requirements of subsection 718.03.D of the Standard Specifications for Construction.

A. Where drilled shafts are located in open water areas, extend the casing a minimum of 12 inches above the water to protect plastic concrete from water action during placement of the concrete. Cut off the casing at the plan top of drilled shaft elevation after the concrete has cured. When practicable, install the casing in a manner that produces a positive seal at the bottom of the casing to prevent the entry of water or other material into the shaft excavation.

B. If it becomes necessary to remove a casing and substitute a longer or larger diameter casing through caving soils, stabilize the excavation with slurry or backfill before installing the new casing. Other methods to control the stability of the excavation and to protect the integrity of the foundation soils may only be used if approved by the Engineer.

C. Do not leave any casing in place unless authorized by the Engineer or shown on the shop drawings. Do not extract a casing until after placing the concrete to an appropriate level.

3. Drilled Shaft Excavation.

A. Provide drilling equipment suitable for excavating the drilled shaft into rock.

B. Excavate the drilled shaft through soil, weathered rock and fresh rock to the tip elevation or depth shown on the plans. Remove all surface and subsurface obstructions encountered in the length of excavation at drilled shaft locations. Use special procedures and tools to remove obstructions, as approved by the Engineer, if the excavation cannot be advanced using conventional augers fitted with soil or rock teeth, drilling buckets, core barrels, and/or under-reaming tools.

C. If satisfactory founding material is not encountered at plan elevation, adjust the bottom of the shaft or alter the foundation, as determined by the Engineer, to comply with design requirements.

D. Do not damage existing structures and utilities. Prevent excessive caving of the excavation. Monitor and control vibrations from the driving of casing or sheeting, or drilling of the shaft, as needed.

E. Construct shafts after the placement of embankment fill and completion of any specified settlement periods unless otherwise shown on the plans.

F. Do not excavate a shaft within two shaft diameters (clear) of an open excavation, or one in which concrete has been placed in the preceding 7 days.

G. The safety of the drilled shaft excavation, surrounding soil and material supported by the soil, and the stability of the sidewalls is the Contractor’s responsibility. The hyrdrovac method is allowed for the first 4 feet below grade with the remaining excavation method as determined by the Contractor and approve by the Engineer.

H. Do not leave drilled shaft excavations unfilled overnight unless the following conditions are met. Dry drilled shafts are drilled shafts where the flow rate of water into the excavation does not exceed 12 inches within 1 hour.

(1) Ensure all open drilled shafts have appropriately sized and attached covers.

(2) Ensure all open drilled shafts in soil are cased overnight.

(a) Dry Drilled Shafts. Temporary casing in dry drilled shafts is acceptable. However, the consequences and the associated costs are the responsibility of the Contractor. Consequences may include, but are not limited to, hole collapse after the temporary casing is withdrawn or the need to leave temporary casing in place when it was not indicated in the contract. No additional payment will be made when temporary casing used to keep the hole open overnight must be left in place.

(b) Wet Drilled Shafts. Ensure wet drilled shafts have casing installed to the plan bottom of drilled shaft or to top of rock, and the excavation within the casing is stopped a minimum distance of 1 foot above the plan bottom of drilled shaft during the nighttime shutdown period. Ensure the excavation to the plan bottom of drilled shaft elevation is made the following day, prior to pouring the concrete.

I. Water within drilled shafts in excess of 3 inches may be pumped provided the flow rate of water into the excavation is less than 12 inches per hour.

J. Using the tremie method is acceptable whether placing the concrete in a wet or dry drilled shaft excavation. Use a watertight tremie consisting of a tube of sufficient length, weight, and diameter (8 inch minimum inside diameter) to discharge concrete at the shaft base elevation. Ensure that the inside and outside surfaces of the tremie are clean and smooth. Place pumped concrete in accordance with subsection 718.03.H.3 of the Standard specifications for Construction.

4. Excavation Inspection. Provide equipment and access for inspection per subsection 718.03.F.1 of the Standard Specifications for Construction.

5. Placing Reinforcing Steel. Must meet the requirements of subsection 718.03.G of the Standard Specifications for Construction. Completely assemble a cage of reinforcing steel which consists of longitudinal and horizontal bars as indicated on the appropriate signal construction details. Provide a fully assembled steel reinforcement cage for inspection, after inspection of the excavation and prior to placement of concrete. Support the cage to control vertical displacement during concrete placement. Ensure steel reinforcement has a clear cover of 3 inches, unless otherwise noted, and may be adjusted to ensure proper clear cover.

6. Concrete Placement.

A. Immediately before placing concrete, ensure that the bottom of the completed drilled shaft excavation is cleaned in accordance with subsection 718.03.F.1 of the Standard Specifications for Construction. Remove drilling spoils that adhere to the vertical sides of the bedrock socket. If not placing the concrete immediately after installing the cage, verify the integrity of the excavated area and ensure that loose/soft material is removed from the bottom of the excavation prior to placing the concrete.

B. Recover slurry and dispose of it as approved. Do not discharge displaced fluids into or in close proximity to streams or other bodies of water. For pours over water, provide a collar or other means of capturing slurry and the top portion of the concrete pushed from the shaft.

C. Concrete Placement. Must meet the requirements of subsection 718.03.H of the Standard Specifications for Construction.

(1) Free Fall Placement. Must meet the requirements of subsection 718.03.H.1 of the Standard Specifications for Construction.

(2) Tremie Placement. Must meet the requirements of subsection 718.03.H.2 of the Standard Specifications for Construction.

(3) Pump Placement. Must meet the requirements of subsection 718.03.H.3 of the Standard Specifications for Construction.

(4) Continuously cast concrete once placement has commenced, until shaft concrete casting is completed. Exposed concrete surfaces must be cast in forms and exposed concrete edges must be beveled 3/4 inches.

D. Construction Tolerances. Must meet the requirements of subsection 718.03.C of the Standard Specifications for Construction.

7. Anchor Bolts. Ensure anchor bolt installation and tightening is in accordance with subsection 810.03.N of the Standard Specifications for Construction. Ensure all installation procedures are witnessed by the Engineer. Ensure anchor bolts and conduits are rigidly installed before the concrete is placed. Space anchor bolts by means of a template. The center of the template must coincide with the center of the foundation. Tighten all top anchor bolt nuts to a snug tight condition.

**e. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

**Pay Item Pay Unit**

Strain Pole Fdn, 6 Bolt, In Rock Foot

**Strain Pole Fdn, 6 Bolt, In Rock** includes excavation of all soil and rock. It also includes all labor, equipment, and material necessary to furnish and install foundation in accordance with this special provision and the contract plans. The foundation is to be measured by the number of feet along the axis of the drilled shaft from the required bottom elevation of the shaft to the proposed top plan elevation. Payment includes excavation; furnishing, placing, and removing steel casings; furnishing, processing, recovering, and disposing of slurry; furnishing and placing reinforcing steel and concrete by free fall, pumping, or tremie method; performing slurry testing; conducting slump tests; backfilling; and disposing of excess excavated material. Separate payment will not be made for the trial excavations. Corrections required to construct the supported elements will not be paid. Payment includes additional concrete required to fill oversize casings or oversize excavations.